Value Vignette

Choosing High-Value Care in Suspected Lower Extremity Deep Vein Thrombosis

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Clinical Scenario
A 70-year-old man with a past medical history significant for combined heart failure, chronic kidney disease stage 3a, type 2 diabetes mellitus, and prostate cancer (status postprostatectomy in 1996 and radiation in 2012) presented from a nursing home for altered mental status (AMS). Altered mental status was initially thought to be secondary to polypharmacy in the setting of new medication administration of Norco and Benadryl the night prior to presentation. At baseline, the patient ambulated independently and required no oxygen supplementation.

Upon exam, vital signs were stable except for requiring 2 liters of oxygen supplementation via nasal cannula to keep oxygen saturation >90%. Bilateral lower extremity (BLE) pitting edema (3+) to the knees and tightness were noted with mild tenderness to palpation bilaterally and without erythema. Bibasilar breath sounds were diminished. Cardiac exam was normal. Weight was 76 kg with a baseline weight of 72 kg. Initial abnormal labs included an elevated creatinine of 3.1 mg/dL, venous lactic acid of 4.2 mmol/L, brain natriuretic peptide of 1450 pg/mL, chest X-ray with cardiomegaly, and chronic bilateral pleural effusions.

Home medications furosemide and metolazone were initially held due to the elevated creatinine and lactic acidosis.

The patient’s AMS improved on day 2; his respiratory status, however, worsened and required 4 liters of oxygen supplementation. Bilateral lower extremity edema, tightness, and tenderness were noted to be worse. Home dose of furosemide and metolazone was restarted.

Treatment Options

Option A: Obtain BLE venous duplex with compression for worsening BLE symptoms to rule out an acute deep vein thrombosis (DVT). BLE venous duplex with compression for DVT was negative. Respiratory status and BLE symptoms improved with diuretics.

Option B: Obtain Well’s score: -2. Negative for active cancer, recent paralysis, paresis, or immobilization of lower extremities, recently bedridden, recent major surgery, localized tenderness along the distribution of the deep venous system, entire leg swollen, calf swelling of 1 lower extremity at least 3 cm larger than the other side, pitting edema confined to the symptomatic leg, previous DVT. Positive for an alternative diagnosis being more likely (decompensated heart failure). Low pretest probability for a lower extremity DVT; therefore, obtain a D-dimer: 0.15 mcg/mL (negative). Since the pretest probability is low and D-dimer negative, we can conclude that there is no DVT without obtaining a lower extremity venous duplex with compression study. Respiratory status and BLE symptoms improved with diuretics.

Discussion Questions
1. What is the initial approach to a patient with signs or symptoms of lower extremity DVT (ie, unilateral or bilateral lower extremity edema and/or erythema and/or pain)?
   a. Obtain lower extremity venous duplex with compression study
   b. Obtain a D-dimer
   c. Obtain pretest probability by using the Well’s score
CHOOSING HIGH-VALUE CARE IN SUSPECTED DVT

**Answer:** Using the Well’s score for DVT to determine the pretest probability is the most important initial step. In patients with a low or moderate pretest probability (Well’s score of -2 to 2), a highly sensitive D-dimer test should be the initial test rather than a venous duplex with compression. In patients with a high pretest probability (Well’s score of ≥3), a venous duplex with compression should be the initial test.

2. What is the value of D-dimer in diagnosing a lower extremity DVT?

   a. Highly specific test to rule in a DVT
   b. Highly sensitive test to rule out a DVT
   c. Highly specific and sensitive test to rule in and rule out a DVT

**Answer:** D-dimer is a highly sensitive test to rule out a DVT but lacks specificity. There are multiple D-dimer assays available. According to Di Nisio et al, enzyme-linked immunofluorescence assay (ELFA), microplate enzyme-linked immunosorbent assay (ELISA), and quantitative latex assay had the highest sensitivities for DVTs with 97%, 95%, and 96% but had specificities of 42%, 47%, and 48%, respectively. A value <500 ng/mL or <0.5 mcg/mL fibrinogen equivalent units (FEU) has been frequently studied, but the cutoff value can vary by institution. D-dimer value <0.42 mcg/mL FEU is considered a negative value at Greenville Health System (GHS).

**Costs**

**Option A:** $508 for BLE venous duplex with compression

**Option B:** $27 for D-dimer

*Costs were obtained from heathcarebluebook.com. These costs are estimates and represent the amount typically paid by an insurance company.

**Teaching Moment**

The most frequently utilized initial diagnostic tool for a suspected acute lower extremity DVT at GHS is a venous duplex with compression. This approach is time consuming and very costly with a low positive yield. The diagnostic pathway recommended by American College of Chest Physicians (ACCP) and similarly by the National Institute for Health and Care Excellence (NICE) presents a cost-effective, safe, and easy-to-use guideline for clinicians to diagnose lower extremity DVT.

In patients who present with signs or symptoms of lower extremity DVT (ie, most commonly, unilateral or bilateral lower extremity edema and/or erythema and/or tenderness), the initial diagnostic test should be guided by the clinical assessment of pretest probability by utilizing the Well’s score for DVT. In patients with a low or moderate pretest probability (Well’s score of -2 to 2), a highly sensitive D-dimer test should be the initial test rather than a venous duplex with compression. In patients with a high pretest probability (Well’s score of ≥3), a venous duplex with compression should be the initial test.

D-dimer is a sensitive test but lacks specificity for the diagnosis of DVT and is, therefore, only useful when negative (ie, D-dimer value <0.42 mcg/mL FEU at GHS). A negative D-dimer level in conjunction with a low-to-moderate clinical probability of DVT is useful and cost-effective in excluding DVT without the need for an ultrasound examination. D-dimer values may be falsely elevated as a result of multiple factors: Most notably, the patient’s age (>60) and renal dysfunction were associated with false-positive D-dimer levels in 57% and 44% of venous thromboembolism-negative patients, respectively. Other factors that can lead to a falsely elevated D-dimer include recent surgery, trauma, pregnancy, and cancer.

There are multiple D-dimer assays available; at GHS, D-dimer is measured via the quantitative latex assay in mcg/mL FEU. According to Di-Nisio et al, ELFA, ELISA, and quantitative latex assay had the highest sensitivities for DVTs with 96%, 95%, and 93%, respectively. Another study by Bates et al showed that in patients with low-to-moderate pretest probability of DVT, a quantitative latex D-dimer assay reliably excluded DVTs.

**Intervention and Result**

We performed a retrospective review of all patients diagnosed with lower extremity pain, edema, or swelling who had a unilateral or bilateral lower extremity venous duplex with compression performed during their hospitalization at GHS’ Greenville Memorial Hospital between October 2014 and September 2015. The aim was to evaluate clinicians’ approach to patients with possible lower extremity DVTs and determine what measures could have been applied to provide a safe and most cost-effective work-up. Patients in the outpatient setting, surgical patients, pediat-
ric patients, patients with suspected pulmonary embolism, and patients with suspected upper extremity DVT were excluded.

Depending on the clinical assessment of pretest probability by utilizing the Well’s score for DVT, patients were categorized into groups of low, moderate, or high risk for a lower extremity DVT. Out of 68 total patients, 59 patients were categorized into the low-to-moderate risk group. Fifty-seven out of those 59 patients had a negative venous duplex with compression study. Ten out of the total 68 patients had undergone a D-dimer. Out of those 10 patients, 4 patients who were part of the low-to-moderate risk group had a negative D-dimer and had a negative venous duplex with compression study.

If all 59 patients in the low-to-moderate risk group had a D-dimer level drawn initially (as recommended by ACCP and per NICE guideline) instead of a venous duplex with compression study, a total of $25,506 could have been saved. During the same time frame, GHS (inpatient only) as a whole had a total of 218 venous duplex with compression studies (unilateral and bilateral) of the lower extremities ordered. Extrapolating the data from the study to the entire GHS, a potential total of $78,262 could have been saved.

**Proposal:** In patients who present with a suspected lower extremity DVT (unilateral or bilateral lower extremity edema and/or erythema and/or tenderness), the initial diagnostic test should be guided by the clinical assessment of pretest probability by utilizing the Well’s score for DVT.

In patients with a low or moderate pretest probability (Well’s score of -2 to 2), a D-dimer test should be the initial test rather than a venous duplex with compression study. If the D-dimer is negative (<0.42 mcg/mL), no further testing is recommended. If D-dimer is elevated above 0.42 mcg/mL, a venous duplex with compression study is recommended and, depending on those results, treatment can be started.

In patients with a high pretest probability (Well’s score of ≥3), a venous duplex with compression study should be the initial test. If positive, treatment can be started.

**References**


